Multi-Mission Earth Entry Vehicle
Design Trade Space and Concept Development Status
(Version 2.0)

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ABSTRACT

The Multi-Mission Earth Entry Vehicle (MMEEV), directed as part of the In-Space Propulsion Technology (ISPT) Program, is based on the Mars Sample Return (MSR) EEV design and was first introduced at IPPW6. The MMEEV is a flexible design concept which can be optimized and/or tailored by any sample return mission, including lunar, asteroid, comet, and planetary (including Mars), to meet that mission's specific requirements. By leveraging common design elements, this approach could significantly reduce the risk and associated cost in development of EEV technologies across all sample return missions by providing significant cross-feed and feed-forward in the areas of design and development, trade space analyses, testing, and even flight experience.

This presentation describes the current status of the MMEEV concept development, with focus placed on the changes and updates made, specifically in the parametric vehicle model, since version 1.0 was completed in early 2010 (and presented at IPPW8). An overview of a MATLAB vehicle model, which includes increased fidelity in the areas of iterative sizing for payload accommodation, impact attenuation sizing based on impact velocity estimates, structural sizing based on estimates of entry loads, and increased definition of the payload itself, is presented. In addition, application of this vehicle model in both a "standard" and "MSR-like" mode is described. Validation of this model, in both geometry and mass properties, using the Pro/Engineer (ProE) software is also discussed. Engineering estimates of MMEEV vehicle and trajectory performance, generated using the NASA Langley Research Center's Program to Optimize Simulated Trajectories (POST2) 6-DOF simulation software, across the entirety of the vehicle and mission trade space are also presented, with emphasis on comparisons with the version 1.0 results.

Future plans for continued MMEEV development are also discussed. These include the next steps in development of current models, as well as the addition of new models, such as an aftbody TPS MER and thermal soak. Plans for integration of the MMEEV multi-discipline analysis models into the System Analysis of Planetary Entry, Descent and Landing (SAPE) tool, originally developed under ISPT for utilization on aerocapture mission studies, are also presented.